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Characteristics of women exposed and unexposed to environmental tobacco smoke (ETS) in a general population sample of North Italy (Po River Delta epidemiological study)

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Abstract. To define qualitative and quantitative categories of exposure to environmental tobacco smoke (ETS) and to assess possible differences for life-style factors between exposed and unexposed women, we studied 867 nonsmoking women (8–73 aged), selected from a general population sample living in the Po Delta area (near Venice, North Italy). Information was collected by a standardized questionnaire. ETS exposure at home, at work or elsewhere was considered. There was a prevalence of ETS exposure of 46% in the whole sample; the rate had a negative association with age. Exposure to ETS occurred more frequently at home, either singly (56%) or in combination with school/work and other places (75%). Exposed women were significantly younger, taller and lighter than those unexposed. Logistic regression on 20+ aged women showed that single-separated-widowed, workers, women living in a rental house, and women with a central forced air heating were significantly more exposed to ETS. Crowding index (n inhabitants/n rooms of the house) was significantly higher in those exposed. These results indicate that ETS exposure is quite frequent in Italian women and that some life-style factors (e.g. marital status or occupational status or some home characteristics), should be considered in the study of relationship between passive smoking and respiratory health.

Key words: General population, Environmental tobacco smoke, Epidemiological survey, Women

Introduction

The role of passive smoking, environmental tobacco smoke (ETS) in producing cardiovascular or respiratory diseases in adults is not completely clear. In several studies a correlation between involuntary tobacco smoking and increased relative risk to have respiratory disorders was shown [1–5]. In a Russian study, an elevated risk of lung cancer was observed in women whose husbands smoked [6]. In Canada [7], involuntary smoking (at home, at work, or elsewhere) may cause about 330 such deaths annually, and that about 50–60 deaths from lung cancer annually result from exposure to spousal smoking. On the contrary, other studies did not find statistical association between exposure to ETS and lung cancer [8]. This discrepancy could be explained by the possible presence of bias, due to misclassification of the subject's nonsmoking status, of the disease status, or of the spouse's smoking habits [9, 10]. However, other studies [11, 12] found that nonsmoking women exposed to passive smoking differ from those unexposed for several factors, such as age, dietary regimen, educational and/or marital and/or occupational stata, height, weight, and other factors to be taken into account in future studies about the influence of passive tobacco smoking on health. In fact, such different characteristics between exposed and unexposed subjects might act as confounders or effect modifiers in the relationship between passive smoking and health outcomes.

The interpretation of epidemiological studies on ETS depends on the validity of self reported exposure [13]. Moreover, intensity, duration, and cumulative exposure to ETS at different places, as well as at home, at school/work, and in other places, may vary in different populations with respect to risk of diseases.

The aim of this report is to define qualitative and quantitative categories of exposure to ETS in women of a general population sample and to assess whether nonsmoker women exposed and unexposed to involuntary smoking differ in some life-style characteristics.

Methods

Eight-hundred-and-sixty-seven never smoking women were selected from a general population sample (n = 2841, 1499 females), who participated in the

second cross-sectional survey (1988–1991) [14] of the Po River Delta epidemiological study on the natural history of chronic obstructive pulmonary disease and its risk factors. For consistency with the other studies, analyses of life-style factors were carried out only on the subjects 20+ years (n = 661). By a standardized interviewer-administered questionnaire [15], developed by the National Research Council (CNR) following that of the National Heart, Lung, and Blood Institute (NHLBI), we collected information on: Age, height, weight, ETS exposure (at home, at school/work, or elsewhere), educational, marital, occupational stata, dietary regimen (slimming diet, hypoglycidic/hypoproteic/hyposodic diet), sport activity, use of contraceptives, alcohol, medicines, current/past respiratory symptoms and diseases, allergological disorders, their familial history and home characteristics (ownership, type of heating, type of fuel for heating or for cooking, crowding index as the ratio of number of inhabitants on number of rooms of the house).

Three types of daily exposure index (DEI) to ETS were computed. The first type was computed as: [(n smokers × n hours of exposure × n days of exposure)/7 (i.e. number of days in the week)] (DEI1). The second type of index was computed as: [(n hours of exposure × n days of exposure)/7] (DEI2). Finally, the third index, was: [(n smokers × n days of exposure)/7] (DEI3).

Frequency distributions, χ^2 test, nonparametric test of Mann–Whitney, logistic regression analysis by SPSS-X were performed [16]. Statistical significance referred to a $p < 0.05$.

Results

Table 1 shows that 46% of women were exposed to ETS. Exposure to ETS occurred more frequently at home, either singly (56%) or in combination with exposure at school/work and other places (75%). The likelihood to be exposed at school/work was the same as at other places. Ten percent of women resulted unexposed at home and at school/work, while they were exposed in other places. Only 1.4% of subjects were exposed everywhere (at home and at school/work and in other places) (Table 1).

Table 1. ETS exposure of never smoking women by location

	N	%
Exposed	400	46.1[a]
Unexposed	467	
Total	867	
Location of exposure		
(1) Broad categories		
Home	299	74.8[b]
School/work	94	23.5
Other places	96	24.0
(2) Detailed categories		
Home only	225	56.3
Home and school/work	26	6.5
Home and other places	36	9.0
School/work only	48	12.0
School/work and other places	8	2.0
Other places only	40	10.0
Everywhere exposed[c]	12	1.4
(3) Unspecified	5	1.3

[a] Percent of total.
[b] Percent of exposed subjects.
[c] At home and at school/work and in other places.

Exposed women were significantly younger (almost by 9 years), taller (by 1 cm), and lighter (almost by 1.5 kg), than those unexposed (Table 2).

With regard to the quantity of ETS exposure, the number of smokers at home was low (mean: 1.5; SD: 0.6), while it was very high in other places, especially for women under 45 years (mean: 50). At school/work the mean number of smokers was 11 (SD: 20). Number of exposure hours per day was similar at home (mean: 3.1 hours; SD: 2.4), and in other places (mean: 2.6 hours; SD: 1.2), whereas it was slightly greater at school/work (mean: 4.8 hours; SD: 3.0). Also the number of exposure days in the week was lower considering exposure in other places (mean: 2.5 days; SD: 1.8) than at home (mean: 6.7 days; SD: 1.1), or at school/work (mean: 5.1 days; SD: 1.0).

Table 2. Age, weight and height of never smoking women by ETS exposure

	Missing	Mean	SD	Median	Min	Max	*p* exposed vs. unexposed[a]
Exposed (n = 400)							
Age (years)	–	33.9	17.4	29.5	8	73	<0.001
Weight (kg)	1	60.6	13.7	59	27	170	0.04
Height (cm)	1	157.9	7.1	158	130	178	0.02
Unexposed (n = 467)							
Age (years)	–	42.6	18.9	45	8	73	
Weight (kg)	1	62.1	12.5	61	26	110	
Height (cm)	1	156.9	6.8	157	131	178	

[a] By non parametric test of Mann–Whitney.

Table 3. Daily exposure index (DEI1)[a] at different locations

Daily Exposure Index	Missing	Mean	SD	Median	Min	Max
(1) At Home (n = 296)	3	4.2	4.0	3.0	0.1	30.0
(2) At School/work (n = 90)	4	48.4	126.4	9.2	0.4	848.6
(3) In other places (n = 92)	4	31.4	31.6	28.3	0.3	169.7
(4) Total[b] (n = 389)	11	21.9	65.8	4.9	0.1	848.6

[a] DEI1 = (number of smokers × number of hours of exposure × number of days of exposure)/7.
[b] Sum of DEI1 at home, at work, in other places.

With regard to the daily exposure indices, the DEI1 was greatest at work, while the lowest was at home (Table 3). Also DEI2 was greater at work (mean: 4.0; SD: 3.6) than at home (mean: 3.0; SD: 3.0), and in other places, it was very low (mean: 0.9; SD: 0.9) (data not shown). DEI3 was higher in other places (mean: 12.7; SD: 15.6) than at home (mean: 1.3; SD: 0.7), and at school/work (mean: 7.9; SD: 14.1), due to the high number of smokers in meeting places and dancing halls (data not shown). Crowding index was significantly higher ($p < 0.001$) in the exposed (0.81) than in unexposed women (0.73).

Larger prevalences of more educated, single-separated-widowed, and of working women in exposed, were found when compared to unexposed, (Table 4).

Unexposed women lived in their own house with central heating significantly more frequently than exposed ($p < 0.001$ by χ^2), who, in turn, had significantly more frequency of central forced air heating (Table 4).

Exposed and unexposed women did not exhibit differentiation of dietary regimen, sport activity, use of contraceptives, medicines, and alcohol.

When all variables that resulted significantly (or borderline significantly) influencing ETS exposure by bivariate analyses were included in the same logistic regression model with any ETS exposure (at home and/or work and/or elsewhere) as dependent variable, the results were confirmed, except for the educational status (Table 5). This model confirmed that the youngest women had a significantly higher risk to be exposed to ETS.

By bivariate regression analysis, ETS resulted a significant risk factor to have asthma (OR: 1.84; $p = 0.02$). When the factors significantly (or borderline significantly) influencing ETS (i.e. type of job, type of heating, house ownership, marital status) were also considered in the logistic regression model, ETS remained a significant risk factor for asthma (OR: 1.9; CI 95%: 1.1–3.4; $p = 0.03$) (Table 6). Thus, with regard to the relation of ETS exposure with asthma (symptoms and/or diagnosis), ETS exposure remained a significant risk factor for asthma also after adjusting for their possible confounding life-style factors.

Discussion

The prevalence of exposure to ETS in this representative population sample of North Italy was high

Table 4. Significant differences between never smoking women exposed and unexposed to ETS (20+ years aged)

	Exposed		Unexposed		p by χ^2 test
	N	%	N	%	
Educational status					
None-primary-junior high school	209	75.2	312	81.9	0.04
High school-university degree	69	24.8	69	18.1	
Marital status					
Separated-single-widowed	60	22.9	39	11.1	0.03
Married	202	77.1	312	88.9	
Type of job					
None[a]	146	52.9	261	68.7	<0.001
Manual worker	59	21.4	45	11.8	
Self employed/manager-employee	71	25.7	74	19.5	
House ownership					
Rent-other	97	35.7	72	19.5	<0.001
Of her own	175	64.3	298	80.5	
Type of heating					
Central	201	74.2	311	84.7	<0.001
Central forced air/limited to few rooms	70	25.9	56	15.3	

[a] Housewives, students, retired, etc.

Table 5. OR and 95% CI for ETS exposure estimated from a logistic regression model in never smoking women (20+ years aged)

	B	OR	CI 95%	*p*
Age	−0.02	0.98	0.97–1.00	0.03
Type of job				
None[a]		1.0		0.06
Manual worker	−0.38	0.69	0.43–1.08	0.10
Self employed/manager-employee	0.19	1.21	0.66–2.22	0.54
Educational status				
None-primary-junior high school		1.0		
High school-university degree	−0.01	0.99	0.58–1.68	0.96
Marital status				
Separated-single-widowed		1.0		
Married	−0.36	0.70	0.46–1.07	0.09
House ownership				
Rent-other		1.0		
Of her own	−0.63	0.54	0.36–0.80	0.02
Type of heating				
Central		1.0		
Central forced air/limited to few rooms	0.53	1.70	1.10–2.62	0.02
Crowding index[b]	0.01	1.01	0.99–1.01	0.15

[a] Housewives, students, retired, etc.
[b] Number of inhabitants/number of rooms of the house.

Table 6. OR and 95% CI for the presence of asthma (symptoms/diagnosis) estimated from a logistic regression model in never smoking women (20+ years aged)

	B	OR	CI 95%	*p*
ETS	0.64	1.90	1.06–3.39	0.03
Type of job				
None[a]		1.0		0.15
Manual worker	0.87	2.40	1.00–5.71	0.05
Self employed/manager-employee	0.57	1.78	0.61–5.16	0.29
Age	0.01	1.01	0.99–1.03	0.30
Type of heating				
Central		1.0		
Central forced air/limited to few rooms	0.53	1.05	0.54–2.06	0.88
House ownership				
Rent-other		1.0		
Of her own	−0.29	0.75	0.41–1.38	0.36
Marital status				
Separated-single-widowed		1.0		
Married	−0.66	0.52	0.29–0.94	0.03

[a] Housewives, students, retired, etc.
[b] Number of inhabitants/number of rooms of the house.

(46%), confirming the findings in other countries, such as Germany (34%) and Poland (43%) [17]. Hopefully, after the recent progress in controlling ETS exposure in public places, these percentages will decrease. Curtin et al., in a study on a representative population of Switzerland, found that 31% never smoker 35+ years women were exposed to ETS. This result was similar to ours, when considering only 35+ years women (37%). Women in North Italy seemed to be more frequently exposed at home than women in Switzerland (56 vs. 42%), whereas the contrary occurred at workplace (24 vs. 31%). Number of hours of exposure in the day was very similar to those found by Curtin et al. (mean: 3.5 hours/day vs. about 3 hours/day). The exposure was confirmed to have the greatest intensity at work [17].

Our results, in accordance with Cress et al. [11], confirmed that never smoker exposed women were younger, and more frequently single-separated-widowed than those unexposed.

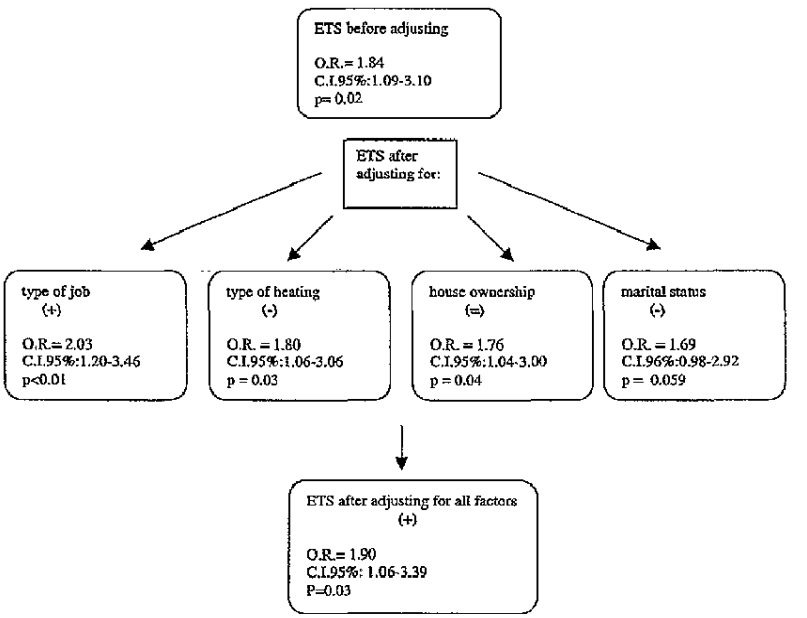

Figure 1. Estimation whether confounding factors dilute (–) or enlarge (+) ETS effects on asthma, by bivariate regressions.

Differently from the results of Cress et al. [11] and Matanoski et al. [12], our exposed women were more educated than those unexposed. Moreover, our exposed subjects weighed less than the unexposed, while Cress et al. [11] found the opposite. A possible explanation regarding the showed greater risk to be exposed to ETS in more educated women could be that, even if a higher educational level can allow a greater awareness of the damage by ETS exposure, more educated women work usually in places where other persons smoke. More precisely, the less educated women attend to work positions less important, with a job organization that does not allow a large diffusion of the smoking habit, and consequently, of the ETS exposure.

It is noteworthy the result concerning the property of the house. We found a significant positive correlation between ETS exposure and rental house. If we consider the ownership of a house as an indicator of income, it seems that socio-economic status, as confirmed by other authors [17], has an inverse relation with ETS exposure.

This is also suggested by the result on crowding index, which is another socio-economic status indicator. Along this line, also the relationship of ETS with type of heating might find an interpretation, although less clearly.

In order to provide an example of relation between ETS and respiratory health with and without adjustment for ETS confounding life-style factors, we chose asthma, in view of its increasing worldwide morbidity since mid-eighties [18–22] and in view of the existence of studies documenting a relationship of asthma to ETS [23–25]. The influence of ETS on asthma remained significant also after adjusting for their possible confounding factors. Figure 1 shows whether the life-style factors that resulted significantly affecting ETS exposure diluted or enlarged the effects of ETS on asthma. Except for the type of job (OR increased from 1.8 to 2.0) and house ownership (OR was unchanged), the other two factors slightly diluted ETS effects. Overall, the relationship of ETS to asthma remained statistically significant.

In conclusion, we have provided the distribution of ETS exposure in a general population of Italian women and we have confirmed that many life-style characteristics are associated with ETS exposure. These characteristics should be taken into account while studying the relationships between ETS and respiratory health, although it seems unlikely that these factors may obscure the relationship of ETS and health outcomes.

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